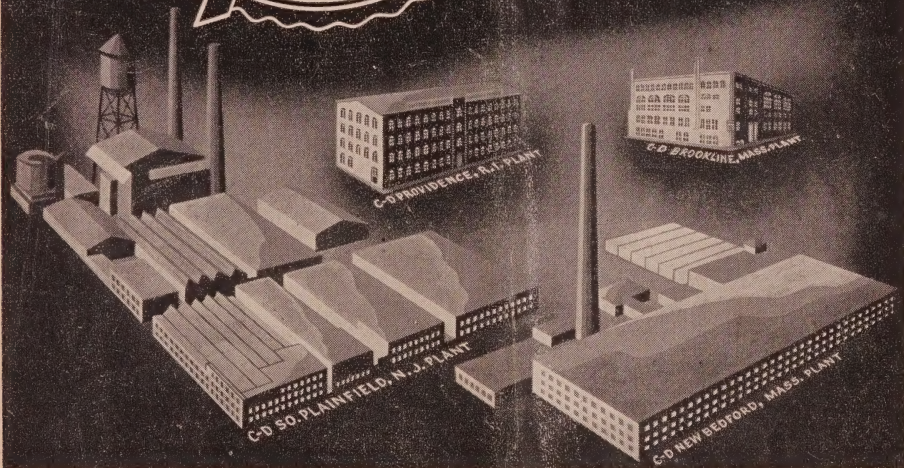


The CORNELL-DUBILIER Capacitor



Vol. 14

NOVEMBER, 1949

No. 11

CORNELL-DUBILIER ELECTRIC CORP.
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1910



1949

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CORNELL-DUBILIER
WORLD'S LARGEST MANUFACTURER OF
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A SERVICEMAN'S R-C-L BRIDGE

A combination bridge for resistance, capacitance, and inductance measurements is as useful to the radio serviceman as to the laboratory technician. This handy instrument, commonly called an impedance bridge, permits the quick identification and testing of all capacitors, resistors, coils, and chokes employed in radio and television circuits. L-C-R bridges are not owned by more servicemen because of the high cost of these instruments as manufactured commercially.

This article gives constructional details of an efficient impedance bridge which can be built and calibrated by any serviceman. It is inexpensive, employs simple easily-obtained components, and requires no expensive equip-

ment for its calibration. This instrument will measure resistance values from 1 ohm to 1 megohm, capacitance from 10 micromicrofarads to 100 microfarads, and inductance from 10 microhenries to 100 henries. Three resistance ranges, four capacitance ranges, and four inductance ranges are provided. The total capacitance range is sufficient to permit measurement of units extending from the lowest-capacitance silver mica types to the very-high-capacitance electrolytics. The inductance range covers all values from small r. f. coils to large iron-core chokes.

Most servicemen already have on hand sufficient spare parts for construction of the bridge. However, if

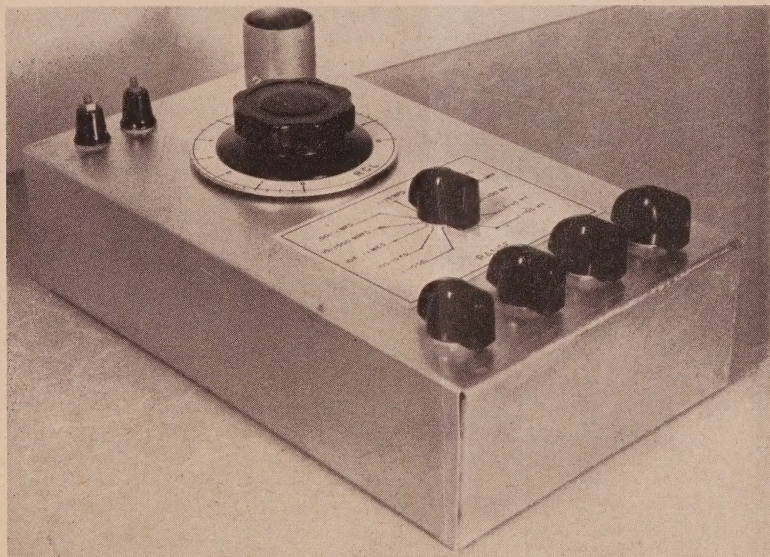


Fig. 1. Overall view of the Serviceman's impedance bridge.

The instrument is built into a standard metal chassis. Resistance, inductance, and capacitance measurements are afforded over a wide range.

Key to Fig. 2

C ₁ —0.0001 ufd. silver mica — Cornell-Dubilier 2R 5T1	R ₁₁ —10,000-ohm linear-taper wirewound potentiometer — I.R.C. W-10,000
C ₂ —0.01 ufd. silver mica — Cornell-Dubilier 1R 3D5	R ₁₂ —1,000 ohms 1 watt carbon — I.R.C. BT-1
C ₃ —1 ufd. oil-filled — Cornell-Dubilier DYR 6100	R ₁₃ —250,000 ohms 1 watt carbon — I.R.C. BT-1
C ₄ —10 ufd. 25 d. c. w. v. tubular electrolytic — Cornell-Dubilier BR 102A	R ₁₄ —1 megohm 1 watt carbon — I.R.C. BT-1
C ₅ —0.1 ufd. 400-v. tubular — Cornell-Dubilier DT 4P1	R ₁₅ —1 megohm 1/2 watt carbon — I.R.C. BT-1/2
C ₆ —8 ufd. 450 d. c. w. v. tubular electrolytic — Cornell-Dubilier BR 845	R ₁₆ —500,000 ohms 1/2 watt carbon — I.R.C. BT-1/2
C ₇ , C ₈ —Dual 8 ufd. 450 d. c. w. v. tubular electrolytic — Cornell-Dubilier BRL 8845	R ₁₇ —1 megohm 1 watt carbon — I.R.C. BT-1
C ₉ , C ₁₀ —0.1 ufd. 400-v. tubular — Cornell-Dubilier DT 4P1	R ₁₈ —2,500 ohms 10 watts wirewound, insulated — Sprague 10KT
R ₁ —10,000 ohms 1 watt 1% tolerance	R ₁₉ —240-ohm line card resistor — J. F. D.
R ₂ —100 ohms 1 watt 1% tolerance	RECT—100-ma. selenium rectifier — Sylvania NC5
R ₃ —1,000 ohms 1 watt 1% tolerance	S ₁ -S ₂ -S ₃ -S ₄ —4-pole, 11-position, non-shorting, rotary selector switch — Centralab 1429
R ₄ —100 ohms 1 watt 1% tolerance	S ₅ -S ₆ -S ₇ —3-pole, 3-position, non-shorting, rotary selector switch — Centralab 1407
R ₅ —10,000 ohms 1 watt 1% tolerance	S ₈ —S.P.S.T. switch attached to potentiometer R ₉
R ₆ —10 ohms 1 watt 1% tolerance	T—3:1 ratio interstage audio transformer — Thordarson T57A38
R ₇ —1,000 ohms 1 watt 1% tolerance	
R ₈ —10,000-ohm linear-taper wirewound potentiometer — I.R.C. W-10,000	
R ₉ —250,000-ohm potentiometer — I.R.C. Type CS	
R ₁₀ —25,000-ohm wirewound potentiometer — Mallory M-25-MP	

all new, top-quality parts are purchased, the full price should not exceed 25 dollars.

The completed bridge is shown in the photograph, Figure 1.

Description of Circuit

The complete circuit schematic is given in Figure 2. A careful examination of this drawing will show that a 4-arm bridge arrangement is employed. The 4-pole, 11-position range switch (S₁-S₂-S₃-S₄) changes the components in three of the bridge arms in such a manner as to set up automatically three different bridge circuits — the Wheat-

stone circuit for resistance, a simple 4-arm circuit for capacitance, and the Maxwell circuit for inductance. The Maxwell bridge has the distinct advantage that it allows an unknown inductance to be checked against a known standard capacitor. This is desirable because standard inductors (required in other types of inductance bridges) are much more expensive and harder for the serviceman to obtain than are capacitors with close ratings.

The bridge is balanced by means of a 10,000-ohm potentiometer, R₈, to which the main dial is attached. The

dial is marked off in a single set of figures which indicate directly micro-microfarads, microfarads, ohms, microhenries, millihenries, and henries. This makes it unnecessary for the operator to perform calculations.

A separate potentiometer, R_{11} , is provided for balancing out the resistive component of the capacitor or coil under test. This is commonly called a power factor adjustment. The 3-pole, 3-position switch, S_5 - S_6 - S_7 , connects this potentiometer in series with the standard capacitor when capacitor measurements are being made, and in parallel with the standard when inductance measurements are being made. When this switch is in its R position, the bridge is set for resistance measurements, and potentiometer R_{11} automatically is cut out of the circuit. Adjustment of R_{11} sharpens the null indication, after a balance first is obtained by adjustment of the main control, R_8 . In the bridge shown in Figure 1, potentiometer R_{11} has not been provided with a direct-reading dial, since this dial normally would read per cent power factor and its indications would be misleading in inductance measurements. However, if an individual builder desires, he may attach a dial to this potentiometer and graduate it directly in ohms. The power factor of a capacitor, or the Q of a coil under test then may be calculated from the resistance setting of R_{11} .

The bridge signal is a 60-cycle voltage supplied by transformer T. The value of signal voltage applied to the bridge may be adjusted by means of potentiometer R_{10} .

The null indicator of the bridge is a 6U5 magic eye tube, ahead of which is a high-gain 6SJ7 amplifier. The sensitivity of the amplifier is regulated by means of potentiometer R_9 .

D. C. voltages for the two tubes are supplied by a half-wave power unit comprised by the selenium rectifier (RECT), filter resistor R_{18} , and the dual electrolytic filter capacitor (C_7 - C_8). The heaters of the two tubes are connected in series and are operated from the a. c. power line through

dropping resistor R_{19} which is a part of the line cord. The ON-OFF power switch, S_8 , is attached to potentiometer R_9 and is switched off when this potentiometer is turned to its extreme left-hand position shaft position.

The standard resistors are R_1 to R_7 . These resistors must be chosen to have the exact values indicated in Figure 2. Under no circumstances should the values vary more than 1 per cent from those given. Carbon resistors may be used if they are picked for exact values; however, best results will be obtained if precision wirewound instrument-type resistors are employed.

The standard capacitors are C_1 , C_2 , and C_3 . Like the standard resistors, these capacitors must be chosen to have the exact values indicated for them in Figure 2. The builder should order capacitors with not more than 1 per cent tolerance.

Constructional Features

Mechanical arrangement of the bridge may be observed from Figures 1, 3, and 4.

Our version of the instrument has been built into a standard radio chassis, 12" long, 7" wide, and 3" high. The chassis made a flat, compact case. Any other suitable type of metal case of the reader's choice may be employed. Figure 1 shows arrangement of the various controls, test terminals, and magic eye hood on the "front panel." These controls are identified in Figure 3.

The main control is a standard 4-inch-diameter radio dial provided with a thin cardboard disc which has been fastened to the dial plate with Duco cement. The dial is graduated in R, C, and L units according to instructions given under Calibration later in this article.

The "unknown" test terminals, seen in the upper left-hand corner in Figure 1, are small-sized ceramic-insulated feed-through terminals. These terminals, which are mounted through $\frac{1}{2}$ " diameter clearance holes, permit wide clearance between the terminal screws and the chassis through which they pass. This reduces terminal-to-

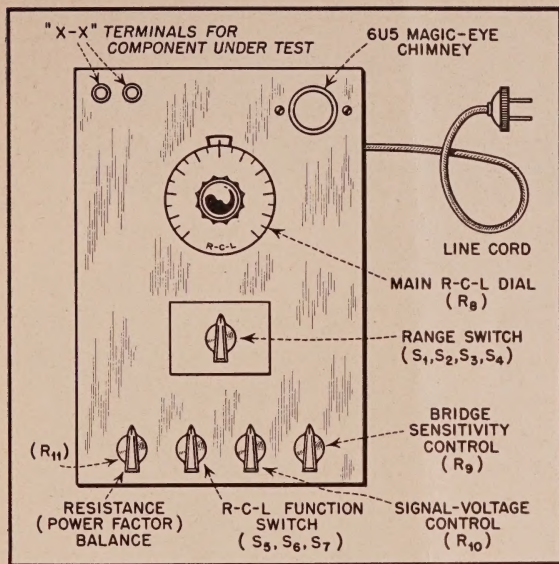
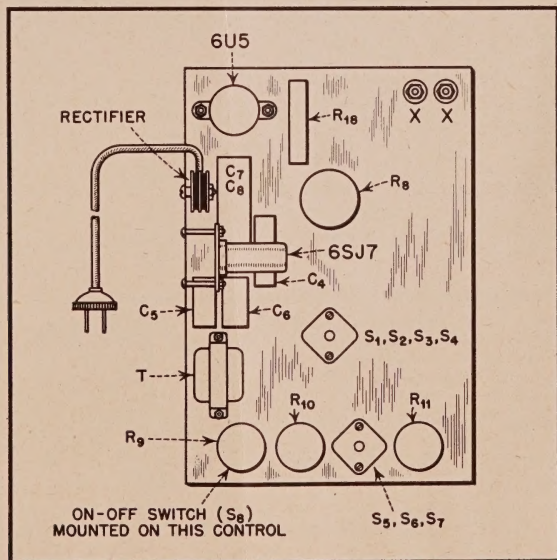


Fig. 3.
Panel
layout.

Fig. 4.
Layout
of
components.



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MODEL NO.	DC INPUT VOLTS	AC OUTPUT VOLTS	OUTPUT WATTS	APPLICATIONS	SIZE	WEIGHT LBS.	LIST PRICE	DEALER'S NET
6RS	6	110 V 60 cycle	50	Mobile	6 3/4 x 7 3/4 x 5 3/4	12	\$ 41.95	\$25.17
6RT0	6	110 V 60 cycle	100		7 x 12 1/4 x 7 1/2	19	59.50	35.70
12R8	12	110 V 60 cycle	80	Marine and	6 3/4 x 7 3/4 x 5 3/4	12	41.95	25.17
12RU15	12	110 V 60 cycle	150	Mobile	7 x 12 1/4 x 12 1/2	22	78.95	47.37
32R8	32	110 V 60 cycle	80	Farm and	6 1/4 x 7 3/4 x 5 3/4	13 1/4	48.50	29.10
32RU15	32	110 V 60 cycle	150	Marine	6 3/4 x 12 3/4 x 7 1/2	22 1/4	73.50	44.10
110PA5	110	110 V 60 cycle	50VA	Record	3 3/4 x 6 1/4 x 2 3/4	2	14.95	8.97
110PB5	110	110 V 60 cycle	50VA	Players	3 3/4 x 6 1/4 x 2 3/4	2	16.95	10.17
110RA15	110	110 V 60 cycle	150	Radio & TV	6 3/4 x 7 3/4 x 5 3/4	13 1/2	48.75	29.25
110R10	110	110 V 60 cycle	100	For AC	6 3/4 x 7 3/4 x 5 1/4	10 1/2	39.95	23.97
110R15	110	110 V 60 cycle	150	Power from	6 1/4 x 12 1/4 x 7 1/2	15	66.95	40.17
110RT15*	110	110 V 60 cycle	150	DC Lines	6 3/4 x 12 1/4 x 7 1/2	16 3/4	65.00	39.00
110RT25*	110	110 V 60 cycle	250	in City	6 1/2 x 12 3/4 x 8 1/2	22 1/2	69.95	41.97
110RT35*	110	110 V 60 cycle	350	Areas	7 1/2 x 14 x 8 3/4	40 1/2	119.50	74.70

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SMOOTH DC POWER — 6 or 12 volts — from 110 volt AC line.
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MODEL NO.	OUTPUT	WATTS	SIZE	WT. LBS.	LIST PRICE	DEALER'S NET
110BA6	6V DC @ 10A.	60	7 3/4 x 12 1/4 x 8 1/2	16	\$54.95	\$32.97
110BA12	6V DC @ 20A. 12V DC @ 10A.	120	7 3/4 x 13 x 8 1/2	24 1/2	85.50	51.30



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If your jobber cannot supply you with these C-D Powercons, write directly to us: CORNELL-DUBILIER ELECTRIC CORPORATION, Dept. HO59, South Plainfield, New Jersey. We will ship your order through your nearest C-D distributor.

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chassis capacitance which appears in parallel with a capacitor under test.

The socket of the magic eye tube is "slung" beneath the chassis and the tube extends through a clearance hole into the protecting and light-shielding chimney seen in the upper right-hand corner in Figure 1. This chimney is a 1½-inch-diameter radio shield, 11½ inches high. It is secured to the chassis by means of spade bolts.

Figure 4 shows arrangement of the principal components inside the chassis. The standard capacitors (C_1 , C_2 , and C_3) and the standard resistors (R_1 to R_7) are grouped around the range switch (S_1 - S_2 - S_3 - S_4) and are omitted from this drawing for the sake of clarity. The various other capacitors and resistors are mounted on insulated terminal strips. For convenience and to minimize the amount of drilling and bolting, these terminal strips are soldered directly to chassis.

While a compact, line-operated half-wave power supply has been shown in the circuit diagram, a transformer-type power supply may be used if this type is preferred and the size of the instrument case can accommodate it. The supply should deliver from 100 to 250 volts of filtered d. c.

The only special precautions necessary in wiring the bridge are (1) to keep all tube heater wiring close to the chassis, and (2) to employ solid No. 12 or No. 14 bus wire in all wiring except that in the power supply, amplifier, and eye-tube circuits. The lead running from the center contact of potentiometer R_8 to the 6SJ7 grid must be covered with shield braid and each end of the braid must be grounded to the B-minus terminal of the power supply.

Calibration

If the bridge dial is calibrated on the resistance range, it will serve without additional calibration also on the capacitance and inductance ranges. The following simple calibration procedure may be followed.

(1) Disconnect the center and right-hand contacts of potentiometer R_8 temporarily from the bridge circuit.

(2) Connect the center and left-hand contacts (viewed from the dial) of the potentiometer to a good ohmmeter or resistance bridge.

(3) By means of the ohmmeter, set potentiometer R_8 to 100 ohms. Mark this setting 1 on the dial.

(4) Advance the potentiometer to 1,000 ohms and mark this point 10 on the dial.

(5) Repeat the operation at each 1,000 ohms, marking the corresponding points 20, 30, 40, 50, 60, 70, 80, 90, and 100 on the dial. (NOTE: At the time the photograph, Figure 1, was made, the dial shown on this instrument had been calibrated in other units for a special purpose.)

(6) Repeat the operation at as many intermediate points as practicable to obtain fine divisions for the dial.

(7) Ink-in the figures and lines on the dial and reconnect potentiometer into the bridge circuit.

The accuracy with which the bridge may be calibrated by the method just described depends upon the accuracy of the ohmmeter used and also upon the care with which potentiometer R_8 is set to the various resistance values.

A second calibration method of high accuracy requires a decade resistance box of the laboratory type having units, tens, hundreds, and thousands decade units. The decade box is connected to the X-X terminals of the bridge, and the bridge is set up for resistance measurement by switching S_6 - S_8 - S_7 to position R, and setting the range switch (S_1 - S_2 - S_3 - S_4) first to 1-100 ohms.

(1) Set the decade box to 1 ohm, advance potentiometer R_{10} a small amount, and set potentiometer R_8 to maximum. Adjust the main dial (potentiometer R_8) for null, as indicated by maximum opening of the 6U5 eye tube. Mark this point 1 on the dial.

(2) Set the decade box successively to equal resistance steps up to 100 ohms. Balance the bridge for each of these settings of the decade box, and mark the corresponding resistance on the dial. In using this method, follow

the instructions given under Using the Instrument for making the resistance balances.

Using the Instrument

Preliminary

(1) Insert the power plug into an a. c. outlet (Caution: the bridge will not operate on a d. c. line voltage, and in fact will be damaged by d. c.).

(2) Switch-on the power by advancing potentiometer R_9 sufficiently to click-on the ON-OFF switch, S_8 .

(3) Wait for about 3 minutes for the tube heaters to reach normal operating temperature. Observe that the 6U5 eve tube will glow green.

(4) Set potentiometer R_9 at about half-scale, and potentiometer R_{10} to minimum.

Resistance

(1) Set the FUNCTION switch (R_5, R_6, R_7) to position R.

(2) Set the RANGE switch (S_1, S_2, S_3, S_4) to its 1-100-ohm position.

(3) Connect the unknown resistance to terminals X-X by means of short leads.

(4) Advance potentiometer R_{10} about $\frac{1}{4}$ inch.

(5) Adjust the main dial throughout its range, watching for a sharp opening of the magic eye. If the opening is too fast, or "hair-trigger," for close adjustment of the dial to the null point, reduce the setting of the sensitivity control (R_9). If no eye opening is obtained, change the range switch setting to the next higher range and retune the main dial. Repeat this procedure on each resistance range until a null indication is obtained. At the point of exact null (widest opening of the eye), read the unknown resistance value by means of the main dial and the range switch setting.

(6) Always use the lowest possible setting of potentiometer R_{10} which will afford a clean, sharp eye opening, especially on the 1-100-ohm range. It may be necessary to jockey back and forth between settings of R_9 and R_{10} in order to obtain best bridge action.

Capacitance

(1) Set the function switch to position C.

(2) Set the range switch to the 10-1,000-uufd. range.

(3) Set potentiometer R_9 at about half-scale, and advance potentiometer R_{10} about $\frac{1}{2}$ inch.

(4) Connect the unknown capacitor to terminals X-X by means of the shortest possible heavy leads.

(5) Adjust the main dial for a sharp opening of the magic eye. If a null is not obtained even when potentiometer R_9 is advanced to maximum, advance the range switch to each higher capacitance range and retune the main dial. Readjust R_9 and R_{10} for maximum bridge sensitivity.

(6) At null, adjust potentiometer R_{11} for a sharpening of the null response, and recheck the main dial setting for exact null.

(7) Read the unknown capacitance value from the main dial and the range switch settings.

Inductance

(1) Set the function switch to position L.

(2) Set the range switch to its 10-1,000 microhenry range.

(3) Set potentiometer R_9 at about half-scale, and advance potentiometer R_{10} about $\frac{1}{2}$ inch.

(4) Connect the unknown coil to terminals X-X by means of the shortest practicable heavy leads.

(5) Adjust the main dial for a sharp opening of the magic eye. If a null is not obtained, even when potentiometer R_9 is set to maximum, try each next higher capacitance setting of the range switch, repeating tuning of the main dial. Readjust R_9 and R_{10} for best bridge action.

(6) At null, adjust potentiometer R_{11} for a sharpening of the null response, and retune the main dial for exact null.

(7) Read the unknown inductance value from the main dial and the range switch settings at null.



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Please limit your ad to a maximum of 40 words, including name and address. Advertisements will be run as promptly as space limitations permit.

NOTICE TO TRADERS

Owing to the overwhelming number of sale-or-trade ads received, we regret the delay in publishing many of them in these columns due to the number of pages normally devoted to this section.

Therefore, we ask your kind indulgence in this matter by notifying us if you have disposed of the articles, etc., before the ad is published in order to preclude against any disappointment on the part of those answering your ad. Please give date the ad was submitted when writing.

Furthermore, if you find that your ad does not appear in the Trading Post within two months, kindly re-submit your ad. All ads are published in the order they are received and are dropped after two months as being obsolete.

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FOR SALE—BC-1206 Q-Ser. Needs no conversion except for power supply. This is the lazier mans Q-Ser. Good cond. James O. Pullman, 839 Edison Ave., Detroit 2, Mich.

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WANTED—Motorola manual control for 1939 Ford. Also speaker kit. L. Stein, 456 Bedford Ave., Mt. Vernon, N. Y.

WANTED—Zenith 10 tube radio chassis and 12" spkr. Will swap even, one RCA 8 watt amp. and 12" spkr. or cash. D. W. Sheldon, Main St., Hancock Bridge, N. J.

FOR SALE—Precision E-200-C sig. gen. in original carton, never been used, with S.S.S. book included. Will take \$60 money order. John Buza, Jr., R 4, Jefferson, Ohio.

FOR SALE—Riders' Manuals, 1 thru 8, and 10 thru 14, like new and complete, \$100 postpaid. Bill's Radio Shop, 1521 Larabee St., Chicago 10, Ill.

WANTED—Am interested in building a photographic speed-light. Any information as regards approved circuits and material would be appreciated. Theodore J. Wanzell, 1866 Brunner St., Philadelphia 40, Pa.

WANTED—Motorola two way radio telephone, FM. H. H. Riley, R 2, Aiken, S. C.

FOR SALE—Heathkit oscilloscope, 5" model 0-3, completely assembled, works perfectly, \$22.50. Latham Radio Shop, Cuba City, Wis.

FOR SALE OR TRADE—Used and new rifles and guns. Want ham gear or good receiver, cement block machine, or poultry equip. Eddie Howell, Gen Del, Anderson, S. C.

FOR SALE—Webster model 60-6 changer-amplifier, brand new condition, \$25. Alex Ostrow, 2822 Brighton 8th St., Brooklyn 24, N. Y.

WANTED—Hammarlund instruction manual for 4-20 transmitter; and Feb., 1946 CQ; also GE Ham News for June, 1946, vol. 1 Nr. 1. Milton Kalashian, 2 Congress St., Newburyport, Mass.

WANTED—Antenna coil for Gruno radio, model 833, chassis 8H. Have battery sig. gen., sig. tracer, and electric eye control for sale. W. Fuller, 4620 Stafford Rd., Lansing 10, Mich.

FOR SALE—Mark II complete with pwr. supply, canvas cover, mike, fones, shock mounts, pwr. cable, ant. tuner, brand new unconverted, \$50 or swap for Super pro SP-200X, pay diff. in cash. G. F. Gnanadi, Creek Valley Park, Wellington, Ohio.

WANTED—A BC312, 342, 224, 348 rcvr. Have Millen exciter, King Kut tool set, McMurdo 100kc IF amplifier, power supplies, tubes, multimeters, parts, and part cash if needed. B. Ginsberg, 102 Dahill Rd., Brooklyn 18, N. Y.

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TRADE—GE cathode ray oscilloscope, type CRO-3A, in excellent condition. Want AM-FM sig. gen., or what have you? Louis J. Petillo, c/o Meridian Radio, 405 Meridian St., E. Boston, Mass.

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FOR SALE—S-20R Hallicrafters rec., used very little, in perfect shape, \$40. Frank Horvath, 220 Cassell Ave., Barberton, Ohio.

FOR SALE—V.D.X. Junior television antenna, used, but good as new, sent postpaid, \$22. List price, \$67.50. Rex Radio Service, 701 Rex Ave N. E., Canton 4, Ohio.

FOR SALE—Radio Repair Store in Williamsburg, Brooklyn, N. Y. Will arrange terms. Union Radio, 409 Hewes St., Brooklyn, N. Y.

FOR SALE—4" PM speaker with wood cabinet, tonearm and cartridge with excellent response, and Westclox alarm-clock, together \$3, or sell separately. Armand Russo, 160 Sherman Ave., New York 34, N. Y.

FOR SALE OR SWAP—ICS course in Electric Drafting and complete drafting tools including BK Elliott pens and bows. Want sig. gen. or tube tester. L. D. Deloplane, 1015 W. Lafayette St., Norristown, Pa.

WANTED—Cornell-Dubilier model B.N. capacitor bridge. Also Waterman pocket-scope. Henry I. Griffiths, 39-82 65 Place, Woodside, L. I., N. Y.

TRADE—10 meter mobile xmitter, Johnson one cylinder gas engine, 400V-125ma vibrapack, "A" eliminator, code practice oscillator, 6 amp, tungar charger, photo cell amplifier. Trade all or part for television receiver, sound projector or? S. Zuchora, 2748 Meade St., Detroit 12, Mich.

FOR SALE—NRI Radio and Television course, 65 lessons, 60 experiments, plus reference booklets. Also Ghirardi's Radio Physics, Marcus and Levy Radio Servicing, 1949 ARRL Handbook, best offer. Frank Riccardi, 499 DeKalb Ave., Brooklyn 5, New York.

WANTED—Radio magazines and other publications you no longer have use for. H. Latko, 1922 Dickens, Chicago, Illinois.

FOR SALE—Emerson parts, mostly coils of all kinds, for pre-war models. Give part number, I may have what you need. All new. C. De Waal Radio Service, 1743 So. Hackberry St., San Antonio 10, Texas.

FOR SALE—BC375 transmitter complete with six tuning units, antenna tuner, dynamotor, and connecting cables, \$65; BC430 transmitter with six tuning units and companion rec., complete with dynamotor and all connecting cables and control boxes, \$59. Prices FOB, W. J. Tarrant, 1626 No. Michigan Ave., Saginaw, Michigan.

TRADE—N.C. 57, perfect condition, used 3 months. Want console radio and record player in good condition. Prefer older model such as 10 or 12 tube Airline or Scott. Lawrence A. Wilson, Box 65, Daggett, Calif.

SWAP—110V ac portable Warner brush electroplating outfit, complete, used once. Want Precision 251 or similar signal tracer. George Berneburg, 1550 Unionport Rd., Bronx 62, N. Y.

FOR SALE—Wireway wire recorder, 2 spools wire, built in record player, almost new. Cost \$150, will sell for \$85, or trade for good 2 1/4 x 2 1/4 enlarger. Seymour Friedman, 1598 Sterling Place, Brooklyn, N. Y.

FOR SALE—RCA 162-C Chanalyst in brand new condition, used only a few hours, \$100. Frank A. Wiszoky, 3122 Ralph Ave., Cleveland 9, Ohio.

WANTED—Auto radio for '40 Dodge. State price and condition. P. Villesscas, 4553 Fisher St., Los Angeles 22, Calif.

FOR SALE—Natco 16mm sound and silent motion picture projector, portable outfit in perfect condition, asking \$400. Andrew A. Popalio, 211 Washington St., Jersey City 2, New Jersey.

FOR SALE—65 NRI lesson books, 37 job folders, 10 reference books, Audels Radiomans Guide, Everybody's Radio Manual, 100 copies of old QST's, and lots of misc. radio equip. All for \$10 FOB Phila. Joe Segel, 5214 Spruce, Philadelphia 39, Pa.

FOR SALE—Ghirardi's Physics, new condition, \$2.25; Bodine 1/1000 hp, 1800 rpm motor, 60 cycles ac, new, \$4; NRI 1948 VTVM wired, tube, meter, panel, instructions, \$4.50. Samuel S. Potter, Mill Creek Road, St. Augustine, Florida.

FOR SALE—5KVA auto transformer, new, \$25; vibrator power supply, 6V in 250V out, \$2; power supply, 110V-6V 350V 70 ma, \$4; 14 watt amplifier, \$15; R-F ammeter, 0-1A, \$2.50; also misc. transformers. A. Svirnic, 7202 S. Fairfield, Chicago 29, Ill.

EMPLOYMENT WANTED—Experienced engineer, with first class phone license, 20 years old, single, and willing to travel anywhere, desires employment as a radio operator. Edward A. Gere, 337 St. James Ave., Woodbridge, N. J.

FOR SALE—Standard make radio tubes, just over stocked 39/44 \$1, 6L6G \$1.25, 7B6 - 7Y4 - 7B5 - 46 70 cents ea., some odd ones. All new in sealed cartons. De Kraker Radio Sales & Service, 127 S. Elm St., Zeeland Michigan.

TRADE—Remington 512P Sportsmaster .22 rifle for volt-ohm-milliammeter or amateur bands receiver. Rifle almost new, original cost \$28. J. Bauer, Carrington Dr., Fullerton, Md.

FOR SALE—Espey radio, table model 581, 8 tubes, 3 bands, operates on 115-230V ac-dc or batteries, good condition, \$35. Mark A. Davis, 316 High St., Chattanooga 3, Tennessee.

SWAP OR CASH—1947 Martin 60 outboard motor, 7.2 hp, perfect; Sola constant voltage transformer, 60 cy. sec. 115V at 1.04 amps, perfect; Electronic Designs VTVM plus other desirable equip. Trade for used car, age no objection. C. J. Enright, Jr., 302 East 71 St., New York 21, N. Y.

FOR SALE—Model 3212 Triplett tube tester with one outside roller chart. Best offer. E. Kiehnhoff Radio Service, Box 355, Wathena, Kansas.

TRADE—Signal tracer, Sepco Stap model like new, used only few hours. Want a typewriter, any make, or what have you? Lawrence Walker, 419 Barkly St., Lead, S. Dakota.

TRADE—Dumont 274A, 5" oscilloscope, practically new, never used. Want Webster-Chicago model 80 wire recorder. Daniel J. Gauthier, 27 Park St., Tupper Lake, N. Y.

WANTED—Good communication receiver. Have for trade, 10" Tel-kit less cabinet, intercom set, set of dial phones, and technical mags. all publishers from 1917 up. A. Perrella, 28 Clinton Place, Mt. Vernon, N. Y.

FOR SALE—B.C. 348, converted to ac operation, with speaker and cabinet, all in grey crackle finish. \$50 takes it. Herbert Boynton, 708 E. Powell St., Fort Worth, Texas.

FOR SALE—Supreme vedolyzer, model 560-A; battery eliminators; radio tubes and parts; Radio Craft, Radio News, Radio Retailing and Service Dealer magazines. Frederick R. Shutt, 612 Frantz Ave., Mullens, W. Virginia.

WANTED—1 variable condenser (tuning condenser) for Crosley radio model No. 03CP. Two numbers on this part — B22-1308 and G-39210. Urgently needed, quote price. Donat A. Duquet, Radio and Electrical App. Service, 10 Monument St., Waterville, Maine.

WANTED—Class B audio transformer, 500 watt, multimatch, cash or swap. R. H. Morse, 2621 Kingsland Ave., Oakland 19, Calif.

TRADE—Simpson model 305 tube tester, used very little, original cost \$46.25, good as new. Trade for radio or what have you? Richard P. Croty, 1425 N. Foothill Blvd, Pasadena 7, Calif.

WANTED—Grigsby-Grunow Majestic window display featuring the mysteriously suspended dirigible over which a hoop appears to totally encompass, operates with electric motor. State condition and price. Edward Scribner, 311 Main St., Schoharie, New York.

FOR SALE—Model 80C Karadio, 6 months old, perfect condition, \$70; Hallicrafters model S53, like new, \$50. Dawson Radio and Photo Service, Republic, Mich.

WANTED—Correct alignment data of various trimmers on "McMurdo Silver Masterpiece 5," including IF freq., or from whom I can get said data. Edison Leeds, 660 Riverside Drive, New York City 31, N. Y.

FOR SALE—Hickok model 532 dynamic tube tester; Triplett model 2400 volt, ohm, output meter; model A200 Electronic Instrument sig. gen.; Riders vol. 10; H. W. Sams vol 1; complete line of service books and tools; some tubes. Everything like new. C. W. Green, 924 Walker St., Grand Rapids, Mich.

SELL OR TRADE—Precision sig. gen. E-200; Vomax model 900; Triplett tube tester, model 2413, roll chart attached; Riders', new, 14, 15, 16, 17, 18. \$190, or trade for typewriter and model railroad equip., or what have you? L. L. Rombin, 3314 Midway St., Shreveport, La.

FOR SALE—Meissner model 9-1065 radio-phono-recorder in good condition, complete with mike. Lists at \$174.50, sell for \$99.50 prepaid. Burgeson Radio Service, 1221 Franklin, Shelton, Wash.

FOR SALE OR SWAP—One approved Electronic Instrument sig. gen, model A-100, \$15; one .22 H & R Sportsman pistol, shot about fifteen times. What have you? Akers Radio Service, Rural Regina, Virginia.

SELL OR TRADE—Precision E-200 sig. gen., perfect condition, \$40; 7" TV set, Transvision kit assembled, no cabinet. Want Hallicrafters SX28A, or P.A. system or other transmitter or Communication equip. T. H. Clark, 2732 Harford Rd., Baltimore 18, Md.

WANTED—NRI or Deforest radio and TV course, radio and TV test equip. State condition and price. Glen Par, 1612 Summer St., Philadelphia 3, Pa.

FOR SALE—Hallicrafters SX-28 in excellent condition. First \$123 takes it. Ed Blasic, 1814 A Drive, Erie, Pa.

FOR SALE—14 watt homemade amplifier with dual speed recorder and playback, 3 mike, 2 phono inputs, 12" speaker with baffle, 2-35' cables, Astatic No. 200 mike. Complete, \$130, sent express collect. Charles R. Graff, South Mountain Radio Appl., South Mountain, Pennsylvania.

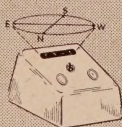
FOR SALE—Dumont 3" scope model 164E. Original cost \$127, will sell for \$45. In excellent condition. G. Greenberg, 821 Porter St., Philadelphia 48, Pa.

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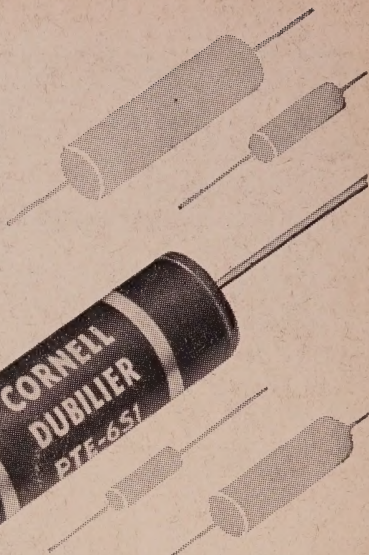
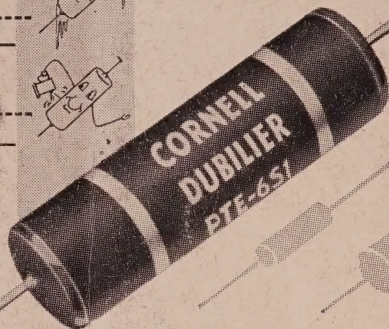
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